PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

BRYER, Kenneth, Robert
K R Bryer & Co.
7 Gay Street
Bath BA1 2PH
ROYAUME-UNI

Date of mailing (day/month/year)	
15 March 2002 (15.03.02)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
P2360-WO	
International application No.	**International filing date (day/month/year)**
PCT/GB00/03845	09 October 2000 (09.10.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
MILNER, Peter, James 100D Leicester Road Hinckley Leicestershire LE10 1LU United Kingdom	GB	GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
BENDING LIGHT LTD 34 Henrietta Street Covent Garden London WC2E 8NA United Kingdom	GB	GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:
Assignment. The person indicated in Box No. 1 has now been recorded as inventor/applicant for the US only.

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Elisabeth KÖNIG
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

BRYER, Kenneth, Robert
K R Bryer & Co.
7 Gay Street
Bath BA1 2PH
ROYAUME-UNI

Date of mailing (day/month/year)	
05 April 2002 (05.04.02)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
P2360-WO	
International application No.	**International filing date (day/month/year)**
PCT/GB00/03845	09 October 2000 (09.10.00)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
FORD-WERKE AG Henry Ford Strasse 1 D-50725 Köln Germany	DE	DE
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
MILNER, Peter, James 100D Leicester Road Hinckley Leicestershire LE10 1LU United Kingdom	GB	GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:
Assignment.

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Kiwa MPAY
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

F. .ENT COOPERATION TREA. .

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 09 July 2001 (09.07.01)	
International application No. PCT/GB00/03845	**Applicant's or agent's file reference** P2360-WO
International filing date (day/month/year) 09 October 2000 (09.10.00)	**Priority date** (day/month/year) 08 October 1999 (08.10.99)
Applicant MILNER, Peter, James	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

04 May 2001 (04.05.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Zakaria EL KHODARY

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
P2360-WO		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/ 03845	09/10/2000	08/10/1999
Applicant		
MILNER, Peter, James et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

   [ ] as suggested by the applicant.

   [X] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

Line 1,5: after "observer" insert "(0)";
Line 1,2: after "opening" insert "(13)";
Line 4: after "component" insert "(14)";

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/03845

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60R1/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 942 962 C (LEDUC RENÉ) 19 April 1956 (1956-04-19) figure 1	1
X	WO 98 36942 A (MILNER PETER J) 27 August 1998 (1998-08-27) page 12, line 18 -page 13, line 14	1,2,5,6
X	WO 92 20553 A (MILNER PETER J) 26 November 1992 (1992-11-26) page 4, line 15 - line 28 page 10, line 24 -page 11, line 15	1,2,8,13
X	DE 295 08 623 U (HOHE GMBH & CO KG) 19 September 1996 (1996-09-19) page 5, paragraphs 1-3	1,15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 January 2001	26/01/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Standring, M

1

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 489 668 A (PONZA ROBERT) 10 June 1992 (1992-06-10) column 2, line 50 -column 3, line 26	1,15
X	WO 98 19888 A (AUTOMOTIVE CONTROL TECHNOLOGIES) 14 May 1998 (1998-05-14) page 2, line 30 -page 4, line 11	1,15
X	GB 815 134 A (SOCIETE GLACAUTO) 17 June 1959 (1959-06-17)	1
A	page 1, line 69 -page 2, line 21	8,13
X	DE 42 10 046 A (DAIMLER BENZ AG) 14 October 1993 (1993-10-14) column 2, line 26 - line 53	1,15
X	DE 23 63 720 A (FORD WERKE AG) 4 July 1974 (1974-07-04) page 3, paragraph 1	1,2
X	DE 87 00 266 U (MICHEL WILHELM) 9 July 1987 (1987-07-09) figure 1	1
X	DE 195 22 900 A (DAIMLER BENZ AG) 15 May 1996 (1996-05-15) the whole document	1
A	"INTERNAL-REFLECTION MIRROR CONCEPT" AUTOMOTIVE ENGINEER,MECHANICAL ENGINEERING PUBL.LTD. BURY ST.EDMUNDS,GB, vol. 18, no. 1, 1 February 1993 (1993-02-01), page 51 XP000345227 ISSN: 0307-6490 the whole document	8,13

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 00/03845

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 942962	C		NONE		
WO 9836942	A	27-08-1998	EP	0961714 A	08-12-1999
WO 9220553	A	26-11-1992	AT	159212 T	15-11-1997
			AU	665539 B	11-01-1996
			AU	1763092 A	30-12-1992
			DE	69222765 D	20-11-1997
			DE	69222765 T	07-05-1998
			EP	0585304 A	09-03-1994
			GB	2255945 A,B	25-11-1992
			JP	7503919 T	27-04-1995
			US	5731900 A	24-03-1998
DE 29508623	U	19-09-1996	EP	0744318 A	27-11-1996
			JP	8337141 A	24-12-1996
			US	5680261 A	21-10-1997
EP 0489668	A	10-06-1992	FR	2670164 A	12-06-1992
			DE	69107969 D	13-04-1995
WO 9819888	A	14-05-1998	US	5790328 A	04-08-1998
			AU	2069997 A	29-05-1998
			EP	0934177 A	11-08-1999
GB 815134	A		NONE		
DE 4210046	A	14-10-1993	NONE		
DE 2363720	A	04-07-1974	GB	1405188 A	03-09-1975
			CA	978401 A	25-11-1975
DE 8700266	U	09-07-1987	NONE		
DE 19522900	A	15-05-1996	NONE		

PATENT COOPERATION TREATY

COPY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

BRYER, K. R.
K. R. BRYER & CO.
7 Gay Street
BATH BA1 2PH
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	11.01.2002

Applicant's or agent's file reference	IMPORTANT NOTIFICATION
P2360-WO	

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/03845	09/10/2000	08/10/1999

Applicant
MILNER, Peter, James et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840	Fisher, N Tel.+49 30 25901-731

Form PCT/IPEA/416 (July 1992)

ATENT COOPERATION TR[illegible]TY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P2360-WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/03845	09/10/2000	08/10/1999
International Patent Classification (IPC) or national classification and IPC B60R1/10		
Applicant MILNER, Peter, James et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04/05/2001	11.01.2002
Name and mailing address of the international preliminary examining authority: European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840	Authorized officer Standring, M Telephone No. +49 30 25901 514

Form PCT/IPEA/409 (cover sheet) (January 1994)

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1,6-10,12-14	as originally filed			
2-5,11	as received on	19/12/2001	with letter of	19/12/2001

Claims, No.:

1-16	as received on	19/12/2001	with letter of	19/12/2001

Drawings, sheets:

1/10-10/10	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 8,11-15.

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

- ☒ the claims, or said claims Nos. 8,11-15 are so inadequately supported by the description that no meaningful opinion could be formed.

- ☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.

   ☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	5,9,10,16
	No:	Claims	1-4,6,7
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-7,9,10,16
Industrial applicability (IA)	Yes:	Claims	1-16
	No:	Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Novelty

Document D2 (WO9836942A) describes an optical system for extending the field of view of an observer through an opening comprising at least two light-diverting optical components 13, 17 (see figures 1 and 2) positioned in the line of sight of an observer such that the light incident thereon from outside the opening at an angle which would not reach the observer is diverted towards the observer by the successive light diverting effects of the said optical components, whereby the said at least two light diverting optical components are optically transparent generally planar elements having inclined facets on one face thereof and substantially uninterrupted surfaces on the other face thereof, the substantially uninterrupted surfaces of the two elements being generally parallel to one another (see page 6, lines 3 to 5) and the two transparent optical elements being made of different material (see page 12, lines 7 to 10) such that the chromatic aberrations introduced upon refraction of the light by one element (is) at least partly compensated upon refraction by the other.

Claim 1 is therefore not new.

Document D2 further describes at least one of the elements being a Fresnel refractor (see page 11, lines 14 to 23).

Claim 2 is therefore not new.

Document D2 further describes the use of three light diverting elements (mirror 12 in figures 1 and 2).

Claim 3 is therefore not new.

In document D2, the facets of one light diverting optical element are inclined with respect to the uninterrupted surface of that element at a different angle to that between

the facets of the other light diverting optical element and the uninterrupted surface of that element (see page 20, lines 9 to 18).

Claim 4 is therefore not new.

In figure 2 of document D2, the optical elements of different material from one another are positioned with their prismatic angles oriented oppositely from one another - one facing away from the light rays, the other facing towards the light rays. Furthermore the apex angles of said optical elements face one another.

Claims 6 and 7 are therefore not new.

Inventive Step

Claim 5: Choosing both or a pair of the at least two light diverting optical elements to have the same angle to the uninterrupted surface of the respective element is a design possibility which the skilled man would consider, taking into account the chromic aberration which would result and is insufficient to justify an inventive step.

Claim 9: In order to reduce the thickness of the element, the skilled man would consider interpenetration of the apex angles to be a normal design possibility. Such a feature is insufficient to justify an inventive step.

Claim 10: Securing at least two of the optical elements by transparent adhesive is known from D3. The use of transparent adhesive is clearly obvious in bonding optical elements. Claim 10 lacks inventive step.

Claim 16: The use of convexly or concavely curved prisms is described for a further embodiment in D2 (page 15, lines 9 to 12). The skilled man would consider the use of convexly or concavely curved refractors to vary image magnitude. Claim 16 lacks inventive step.

R lt m VIII

Certain observations on th international application

The amendments filed with the letter dated 19.12.2001 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following:

Claim 8: Prismatic apex angles of optical elements facing in the same direction is only described in the embodiment with three optical elements (figure 3, page 9, line 23 to page 10, line 19). Claim 8 refers to both a two optical element system and a three optical element system.

Claims 11 to 15: These claims are a combination of two embodiments. The first relies on total internal reflection (page 11, line 22 to page 12, line 11) and therefore is independent of chromatic aberration. The second embodiment requires refractors manufactured from two different materials in order to overcome chromic aberration (page 8, line 18 to page 9 line 21). Such a combination goes beyond the disclosure in the international application as filed.

Such a situation arises, for example when using excavating machinery comprising a bucket or claw carried at the end of an articulated arm on a body or cabin turnable about a vertical axis. The range of movement of the articulated arm can position the bucket at locations which are not visible to the machine operator when seated at the controls in view of the necessarily limited size of the window through which the operator can observe the working of the bucket. Other, similar, situations arise with other forms of machinery involving moving parts, and with locomotive machinery when manoeuvring in confined spaces.

One attempt to solve this problem has been made, in the case of motor vehicles such as vans and motor caravans having very upright rear windows, to assist in reversing the vehicle, by positioning a fresnel refractor on the rear window to divert light arriving from a range of positions closely behind the rear of the vehicle towards the driver. Thus, when reversing, the driver can obtain a view, albeit somewhat distorted, of the region immediately to the rear of the vehicle, a view which would not otherwise be available due to the small size of the rear window, the opacity of the surrounding walls and the distance from the driver's eyes to the rear window.

Such a solution is not applicable in all circumstances where a restricted view may be a problem, however, because the presence of the light-diverting refractor obstructs the normal view through that part of the window or opening occupied by it. This, in turn, limits the size to which such refractors can be usefully made as it is essential to keep a substantial part of the window or opening for the normal direct view as well as to allow the diverted view. One attempt to provide an extended view using prisms is

described in DE 942962. This uses two block prisms to refract light which would not reach the observer through the opening into a path towards the observer. It suffers from the degradation of image quality due to the chromatic aberration which occurs upon refraction, especially through thick prisms.

The present invention seeks to provide a solution to this problem which is capable of enlarging the field of view of an observer through an opening to extend to areas which would otherwise be obscured, without resultant image degradation.

According to one aspect of the present invention, therefore, there is provided an optical system for extending the field of view of an observer through an opening, comprising at least two light-diverting optical components positioned in the line of sight of an observer such that light incident thereon from outside the opening at an angle which would not reach the observer is diverted towards the observer by the successive light-diverting effects of the said optical components, characterised in that the said two light-diverting optical components are optically transparent generally planar elements having inclined facets on one face thereof and substantially un-interrupted surfaces on the other face thereof, the substantially un-interrupted surfaces of the two elements being generally parallel to one another and the two transparent optical elements being made of different material such that chromatic aberrations introduced upon refraction of the light by one element are at least partly compensated upon refraction by another.

In such a system the said light diverting element or system may comprise or include a refractor carried by a mounting so as to be pivotable about an axis transverse the direction of light arriving at an observer at the said predetermined location from the said field of view whereby to be movable between an operative position to be viewed by an observer, and an inoperative position where it does not obstruct the field of view of the observer through the opening. It is preferred that the said axis is located transversely of the said refractor, that is generally parallel to, and, preferably along (or spaced from) one edge of the refractor.

Preferably the refractor is a fresnel refractor, that is one comprising a plurality of elementary refracting surfaces in an array defining a general plane of the refractor.

One of the ways in which the correction or compensation of chromatic aberrations can be improved is by the provision of a composite refractor comprising a plurality of refracting elements oppositely orientated with respect to their light-diverting action. An optical system in which the refractor comprises two fresnel refractors is particularly convenient although three or more refractor elements in an array may be provided.

In another aspect of the invention, there is provided an optical device for extending the field of view of an observer through an opening, comprising a first light-diverting optical component acting to divert light incident thereon through the opening at an angle greater than a critical angle of incidence and to transmit therethrough

undeviated light incident thereon through the opening at an angle less than the critical angle, and a second light diverting component acting to divert the diverted light from the first component towards the observer.

In an embodiment of the invention in this aspect the light-diverter system preferably comprises a composite reflector system having an even number of reflectors.

A first reflector of such a reflector system may comprise a plurality of reflector elements in an array, with each element of the array being orientated transversely with respect to the general plane of the array. Such an array may be of the type generally described in the applicant's earlier British Patent No. 2 255 945.

In a reflector embodiment the second reflector may be pivotally mounted to or adjacent one edge of the said first reflector and, as in the refractor embodiment the reflectors are preferably generally planar in form and mounted in such a way that they can be folded parallel to one another and out of the line of sight of an observer to allow the normal field of view through the opening to be unobstructed when the light-diverter is not deployed.

The present invention also comprehends an optical system for diverting light to an observer from an obscured location, comprising first and second reflective units pivotally connected together for adjustment of their relative inclination, one of the reflective units comprising a plurality of reflective elements in an array extending parallel to the general plane of the said one reflective unit such that light incident on the said one unit is diverted by reflection as it passes through the unit.

In any of the above aspects or embodiments of the invention the reflectors or refractor

40 and one of which, the reflector 38, is pivotally mounted at 41 to the roof 12 of the enclosure adjacent the upper edge of the opening 13.

In this embodiment the reflector 38 may a multiple refractor array as described in relation to Figures 2 or 3 or alternatively a stacked elementary reflector array of the type described in the applicant's earlier British Patent 2 255 945, namely one in which the reflective surfaces are formed as parallel elementary surfaces extending traversely with respect to the general plane of the element itself. This may be achieved by stacking together an array of sheets of transparent material and then cutting through the array perpendicular to the faces of the elements to provide cut sheets with a plurality of parallel interfaces or, alternatively, by bringing together two elements having parallel grooves or other indentations which, in the composite element define a plurality of reflective facets which are spaced from one another parallel to the general place of the array.

The reflector array 38 is pivotally mounted at a proximal edge by a pivot 41 to the roof 12, and by a pivot 40 at its distal edge to a plane reflector 39. The pivotable connections 40, 41 allow the two reflectors 38, 39 to be extended to the deployed position illustrated in Figure 4 or two a folded or "parked" position (also illustrated in Figure 4A) in which both lie substantially parallel to one another and to the roof line 12 and out of the direct line of sight of the operator opening 13.

As can be seen in the inset to Figure 4A the stacked elemental refractor reflector array 38 comprises two transparent sheets 40, 41 each having a plane face 42,43 and an opposite ribbed face having asymmetric parallel grooves separated by

CLAIMS

1. An optical system (14) for extending the field of view of an observer through an opening (11), comprising at least two light-diverting optical components (23, 24; 35, 36, 24) positioned in the line of sight of an observer such that light incident thereon from outside the opening (11) at an angle which would not reach the observer is diverted towards the observer by the successive light-diverting effects of the said optical components (23, 24; 35, 36, 24), characterised in that the said at least two light-diverting optical components (23, 24; 35, 36, 24) are optically transparent generally planar elements having inclined facets (30, 31) on one face thereof and substantially un-interrupted surfaces (22, 29) on the other face thereof, the substantially un-interrupted surfaces (22, 29) of the two elements (23, 24) being generally parallel to one another and the two transparent optical elements being made of different material such that chromatic aberrations introduced upon refraction of the light by one element one at least partly compensated upon refraction by another.

2. An optical system according to Claim 1, characterised in that at least one of the optical elements (23, 24) is a fresnel refractor.

3. An optical system according to Claim 1 or Claim 2, characterised in that there are three light-diverting optical elements.

4. An optical system according to any of Claims 1 to 3, characterised in that the facets (30, 31) of one light-diverting optical element (23) are inclined with respect to

the uninterrupted surface (29) of that element (23) at a different angle from that between the facets (23) of the other light-diverting optical element (24) and the uninterrupted surface (22) of that element (24).

5. An optical system according to any of Claims 1 to 3, characterised in that the facets (30,31) of both or at least two of the light-diverting optical elements (23, 24) are inclined at the same angle with respect to the uninterrupted surface (22, 29) of the respective element (23, 24).

6. An optical system according to any preceding claim, characterised in that at least two optical elements (23, 24; 35, 36, 24) of different material from one another are positioned with their prismatic apex angles oriented oppositely from one another.

7. An optical system according to Claim 6, characterised in that the prismatic apex angles of the said two optical elements (23, 24) face one another.

8. An optical system according to any preceding claim, characterised in that the prismatic apex angles of at least two of the said optical elements (35, 36) face in the same direction as one another.

9. An optical system according to any preceding claim, characterised in that the apex angles of the facets of two of the said optical elements (23, 24) interpenetrate one another.

10. An optical system according to any preceding claim, characterised at least two of the optical elements (23, 24; 35, 36, 24) are secured together by transparent adhesive.

11. An optical system for extending the field of view of an observer through an opening, according to any preceding claim, characterised in that the said two light-diverting optical elements (42, 43) co-operate to divert light incident thereon through the opening at an angle greater than a critical angle of incidence and to transmit therethrough undeviated light incident thereon through the opening at an angle less than the critical angle.

12. An optical system according to Claim 11, characterised in that there is provided a further light-diverting optical component (39) acting to divert the diverted light from the first component (38) towards the observer.

13. An optical system according to Claim 12, characterised in that the said two light-diverting optical components (42, 43) and the said further optical component (39) comprise a composite reflector system having an even number of reflectors.

14. An optical system according to Claim 13, characterised in that a first reflector of the system comprises a plurality of reflector elements formed by the said first and second light-diverting optical components (42, 43) in an array with each reflective element of the array oriented transversely with respect to the general plane of the array.

15. An optical system according to any of Claims 12 to 14, characterised in that the said further reflector (39) is pivotally mounted to or adjacent one edge of the said first reflector (38).

16. An optical system according to any preceding claim, characterised in that the said light-diverting optical elements are convexly or concavely curved.

1893.01 Commencement and Entry [R - 2]

35 U.S.C. 371 . NATIONAL STAGE: COMMENCEMENT

(a) RECEIPT FROM THE INTERNATIONAL BUREAU OF COPIES OF INTERNATIONAL APPLICATIONS WITH ANY AMENDMENTS TO THE CLAIMS, INTERNATIONAL SEARCH REPORTS, AND INTERNATIONAL PRELIMINARY EXAMINATION REPORTS INCLUDING ANY ANNEXES THERETO MAY BE REQUIRED IN THE CASE OF INTERNATIONAL APPLICATIONS DESIGNATING OR ELECTING THE UNITED STATES.

(b) SUBJECT TO SUBSECTION (f) OF THIS SECTION, THE NATIONAL STAGE SHALL COMMENCE WITH THE EXPIRATION OF THE APPLICABLE TIME LIMIT UNDER ARTICLE 22(1) OR (2), OR UNDER ARTICLE 39(1)(a) OF THE TREATY.

(c) THE APPLICANT SHALL FILE IN THE PATENT AND TRADEMARK OFFICE

(1) THE NATIONAL FEE PROVIDED IN SECTION 41(a) OF THIS TITLE;

(2) A COPY OF THE INTERNATIONAL APPLICATION, UNLESS NOT REQUIRED UNDER SUBSECTION (a) OF THIS SECTION OR ALREADY COMMUNICATED BY THE INTERNATIONAL BUREAU, AND A TRANSLATION INTO THE ENGLISH LANGUAGE OF THE INTERNATIONAL APPLICATION, IF IT WAS FILED IN ANOTHER LANGUAGE;

(3) AMENDMENTS, IF ANY, TO THE CLAIMS IN THE INTERNATIONAL APPLICATION, MADE UNDER ARTICLE 19 OF THE TREATY, UNLESS SUCH AMENDMENTS HAVE BEEN COMMUNICATED TO THE PATENT AND TRADEMARK OFFICE BY THE INTERNATIONAL BUREAU, AND A TRANSLATION INTO THE ENGLISH LANGUAGE IF SUCH AMENDMENTS WERE MADE IN ANOTHER LANGUAGE:

(4) AN OATH OR DECLARATION OF THE INVENTOR (OR OTHER PERSON AUTHORIZED UNDER CHAPTER 11 OF THIS TITLE) COMPLYING WITH THE REQUIREMENTS OF SECTION 115 OF THIS TITLE AND WITH REGULATIONS PRESCRIBED FOR OATHS OR DECLARATIONS OF APPLICANTS;

(5) A TRANSLATION INTO THE ENGLISH LANGUAGE OF ANY ANNEXES TO THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT, IF SUCH ANNEXES WERE MADE IN ANOTHER LANGUAGE.

(d) THE REQUIREMENTS WITH RESPECT TO THE NATIONAL FEE REFERRED TO IN SUBSECTION (c)(1), THE TRANSLATION REFERRED TO IN SUBSECTION (c)(2), AND THE OATH OR DECLARATION REFERRED TO IN SUBSECTION (c)(4) OF THIS SECTION SHALL BE COMPLIED WITH BY THE DATE OF THE COMMENCEMENT OF THE NATIONAL STAGE OR BY SUCH LATER TIME AS MAY BE FIXED BY THE COMMISSIONER. THE COPY OF THE INTERNATIONAL APPLICATION REFERRED TO IN SUBSECTION (c)(2) SHALL BE SUBMITTED BY THE DATE OF THE COMMENCEMENT OF THE NATIONAL STAGE. FAILURE TO COMPLY WITH THESE REQUIREMENTS SHALL BE REGARDED AS ABANDONMENT OF THE APPLICATION BY THE PARTIES THEREOF, UNLESS IT BE SHOWN TO THE SATISFACTION OF THE COMMISSIONER THAT SUCH FAILURE TO COMPLY WAS UNAVOIDABLE. THE PAYMENT OF A SURCHARGE MAY BE REQUIRED AS A CONDITION OF ACCEPTING THE NATIONAL FEE REFERRED TO IN SUBSECTION (c)(1) OR THE OATH OR DECLARATION REFERRED TO IN SUBSECTION (c)(4) OF THIS SECTION IF THESE REQUIREMENTS ARE NOT MET BY THE DATE OF THE COMMENCEMENT OF THE NATIONAL STAGE. THE REQUIREMENTS OF SUBSECTION (c)(3) OF THIS SECTION SHALL BE COMPLIED WITH BY THE DATE OF THE COMMENCEMENT OF THE NATIONAL STAGE, AND FAILURE TO DO SO SHALL BE REGARDED AS A CANCELLATION OF THE AMENDMENTS TO THE CLAIMS IN THE INTERNATIONAL APPLICATION MADE UNDER ARTICLE 19 OF THE TREATY. THE REQUIREMENT OF SUBSECTION (c)(5) SHALL BE COMPLIED WITH AT SUCH TIME AS MAY BE FIXED BY THE COMMISSIONER AND FAILURE TO DO SO SHALL BE REGARDED AS CANCELLATION OF THE AMENDMENTS MADE UNDER ARTICLE 34(2)(B) OF THE TREATY.

(e) AFTER AN INTERNATIONAL APPLICATION HAS ENTERED THE NATIONAL STAGE, NO PATENT MAY BE GRANTED OR REFUSED THEREON BEFORE THE EXPIRATION OF THE APPLICABLE TIME LIMIT UNDER ARTICLE 28 OR ARTICLE 41 OF THE TREATY, EXCEPT WITH THE EXPRESS CONSENT OF THE APPLICANT. THE APPLICANT MAY PRESENT AMENDMENTS TO THE SPECIFICATION, CLAIMS AND DRAWINGS OF THE APPLICATION AFTER THE NATIONAL STAGE HAS COMMENCED.

(f) AT THE EXPRESS REQUEST OF THE APPLICANT, THE NATIONAL STAGE OF PROCESSING MAY BE

COMMENCED AT ANY TIME AT WHICH THE APPLICATION IS IN ORDER FOR SUCH PURPOSE AND THE APPLICABLE REQUIREMENTS OF SUBSECTION (C) OF THIS SECTION HAVE BEEN COMPLIED WITH.